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Electricity, the Last of the Sciences

By WM. WIRT MILLS

SO far as the world has advanced at the end of the first decade of the 20th century, electricity is the last as well as the most scientific of the sciences, the most recently developed, the most rapidly expanded, the most widely applied and the most embracing of all branches of human knowledge, in its wide range of constituent facts and varied uses.

Yet the seventeenth century had dawned before William Gilbert made the first discoveries of electric phenomena and the eighteenth century was nearly spent before Galvani detected the electric current. It was a century before Dr. Wall, in 1708, produced the electric spark, and another century before Volta contrived the first battery, converting chemical energy into elecricity, in 1800.

Then a generation elapsed before Faraday's discovery of electro-magnetic induction in 1831 and Jacobi's motor in 1834 made possible the conversion of mechanical energy into electricity that could be harnessed to uses of man.

Meanwhile William Sturgeon, in England, in 1824, had discovered the principle, and Joseph Henry, in America, in 1826, had perfected the electro-magnet, which resulted in the development of a feasible system of telegraphy by S. F. B. Morse in 1837, and its first practical operation between Washington and Baltimore in 1844. Now there are 3,000,000 miles of telegraph wires in use in the world and more than 400,000,000 messages are sent annually.

Meanwhile, in 1858, Cyrus W. Field laid the first cable across the Atlantic and now there are 280,000 miles of sub-marine cables carrying messages from continent to continent with such speed that a message can be sent from New York to London and the answer received in three minutes.

It was not until the year of the American Centennial that electricity found its second great application in the telephone. The theory of the transmission of the sounds of the human voice over wires had been propounded in 1854 by Charles Bourseul, in France, but feasible systems were not devised until 1876, when Bell and Gray made their independent inventions. Now there are 4,000,000 'phones in use and 4,000,000,000 conversations are held annually over wires, the human voice carrying a thousand miles clearly over copper circuits.

Except for the telegraph, electricity was but an interesting phenomenon when Tyndall came to America in 1870 to lecture. He carried 100 Grove batteries to supply current for his experiments and it took two hours to set up the cells and develop electricity. He had no idea that within ten years the current would be on tap in every large hall and would light cities; that within twenty years it would move cars through the streets, and within thirty years would propel trains at high speed.

It was in the very year of Tyndall's American lectures that Gramme brought to a focus the investigations made by many men throughout half a century. His practical dynamo, invented in 1870, has enabled man to turn steam or water power into electric current.

The first fruit of this achievement was the practical application of Sir Humphry Davy's discovery of the Voltaic arc, in 1808, in Brush's arc light in 1878, and Edison's incandescent light in the same year. Now there are over 600,000 arc lights and some 35,000,000 incandescent lamps in use, and central power stations annually supply over $12,000,000 worth of electric current to drive motors.

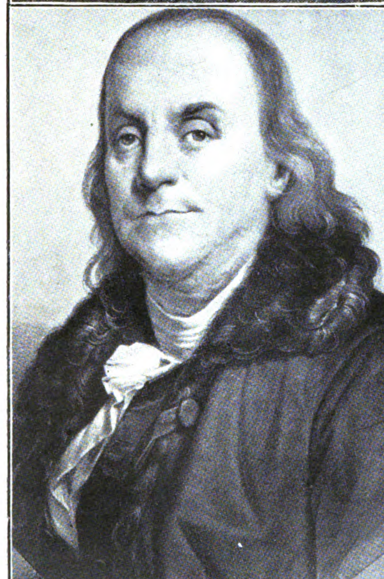
In 1880 the first central station for incandescent electric lighting was begun by Edison in Pearl St., near Fulton, New York City, current being turned on Sept. 4, 1882. The 3,000 light Edison central station built in London, England, antedated this, however, it being in operation Jan. 12, 1882.

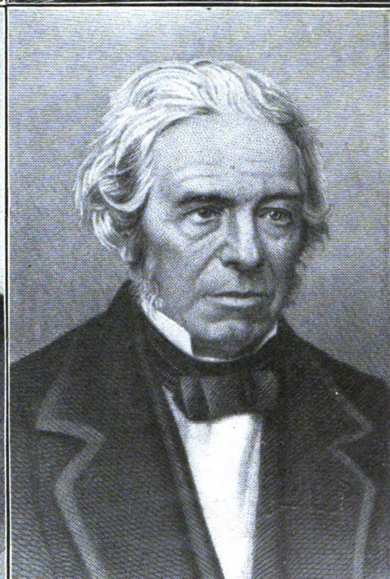
Sprague, in 1886, sufficiently perfected the experiments begun by Davenport in 1850 to set up a feasible electric trolley road. Now there are over a thousand electric railways, with 36,000 miles of tracks, 80,000 cars and an investment of $4,000,000,000. Again in 1890 Sprague gave electric traction a vast development by inventing the multiple unit-system, by which long trains are operated by motors under each car working in unison, as on the elevated railroads and the subway lines in New York City.

In the past twenty years there has been a utilization of the heat of electric currents in furnaces for the reduction of ores or the formation of compounds, and the discovery of the Hertzian waves has led to the marvels of wireless telegraphy and telephoning.









WM. GILBERT, Eng.; 1600, first systematic scientific investigation of electric phenomena.
OTTO von GUERICKE, Germany; 1681, maker of first machine for generating electricity.
BENJAMIN FRANKLIN, America; 1752, discovs positive and negative state of electricity.
MICHAEL FARADAY, Eng.; 1831, electro-magnetic induction, fd. of present science.





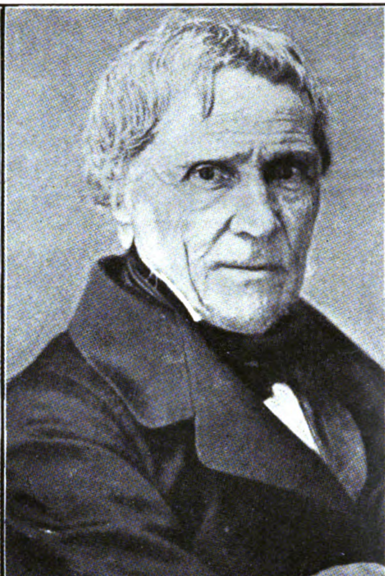


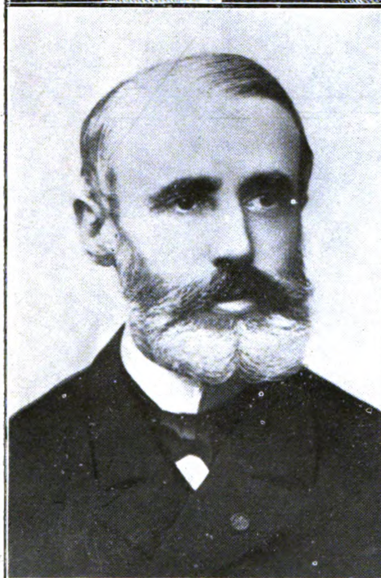


ALESSANDRO VOLTA, Italy; 1800, invented Voltaic pile, first battery, copper and zinc.
GEORGE S. OHM, Germany; '27, formulated law galvanic circuits and electric resistance.

ANDRE AMPÈRE, France; '20, propounded theory of electro-dynamics, modern practice.
KARL FRIEDRICH GAUSS, Germ., '33, electrical measurements, terrestrial magnetism.



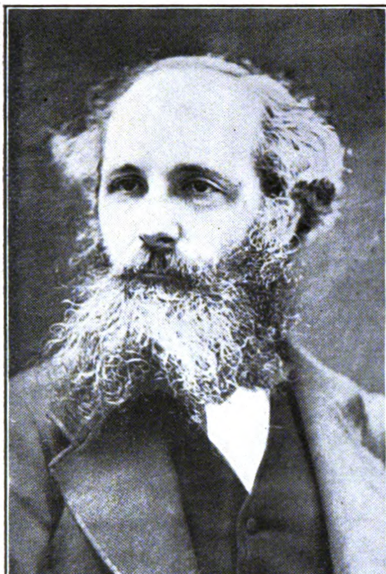


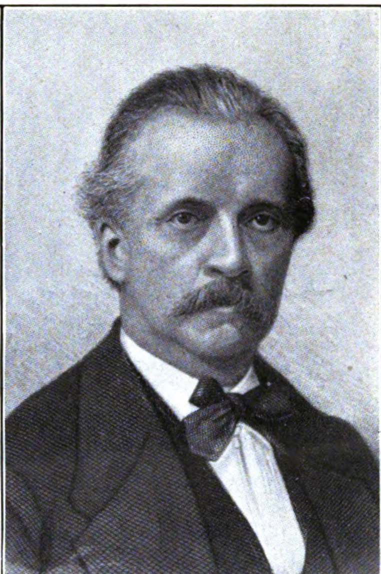




SIR HUMPHRY DAVY, England; 1800, founder electro-chemistry; '08, Voltaic arc.
GASTON PLANTÉ, France; 1860, lead battery; discoverer of modern storage battery.

ANTOINE CESAR BECQUEREL, France; '29, inventor of double-fluid galvanic battery.
CAMILLE A. FAURE, France; '81, composite plates for storage battery, or accumulator.



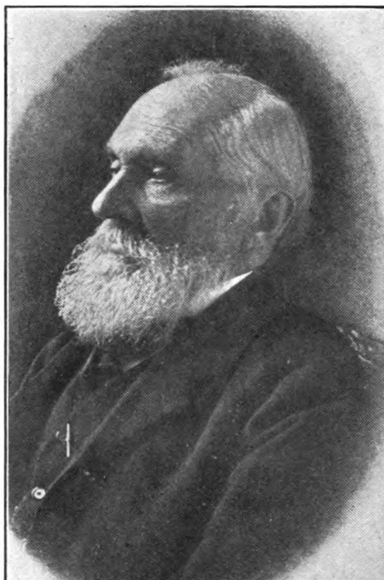


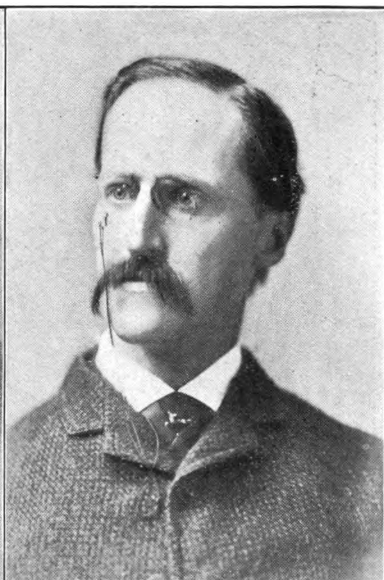


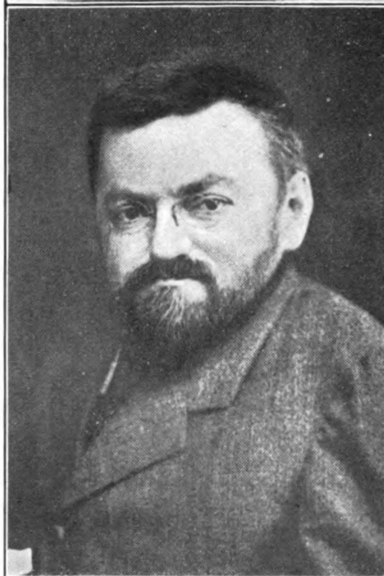


JAMES CLERK MAXWELL, Scotland; '73, founded electro-magnetic theory of light.
JOSEPH HENRY, America; '26, perfected electro-magnet; student terrestrial magnetism.

HERMANN VON HELMHOLTZ, Germany, '80, formulated electro-magnetic theory.
HEINRICH R. HERTZ, Germany; '88, electric wave radiation (Hertzian waves).







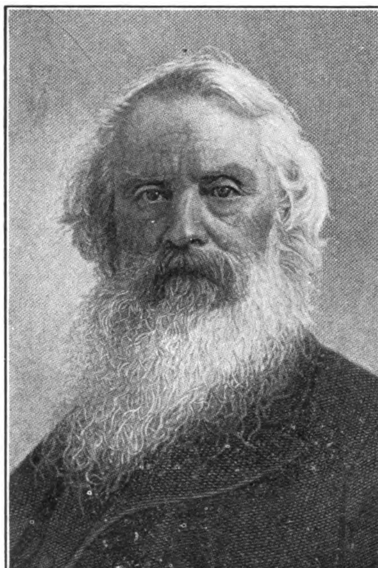


LORD KELVIN (W. Thomson) Eng.; '76-'97, savant, instruments to measure electricity.

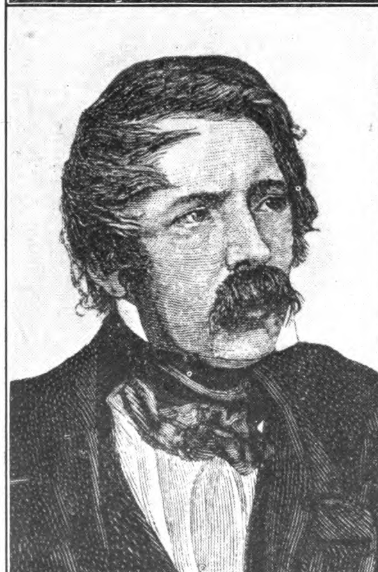
HENRY A. ROWLAND, America; '78, determination of Ohm unit electrical resistance.

CHAS. P. STEINMETZ, America; 1897, formulated practical laws of alternating currents.

SIR JOS. J. THOMSON, England; '97, method of conducting electricity through gases.









S. F. B. MORSE, America, '32, electro-magnetic telegraph; '44 first telegram in U. S.

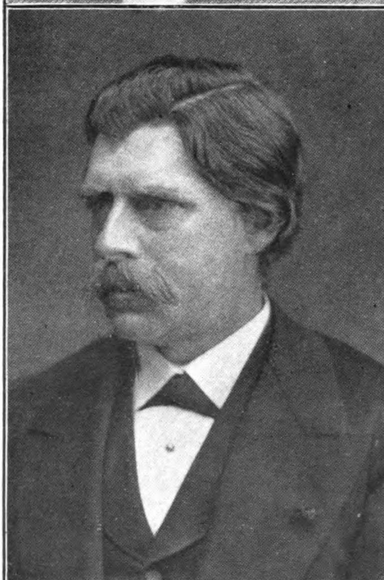
SIR CHAS. WHEATSTONE, England; 1819, musical 'phone; '37, needle telegraph.

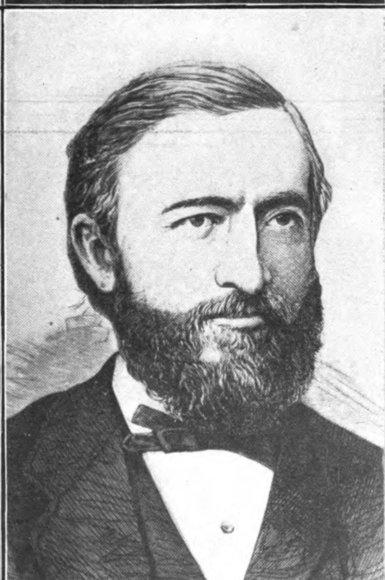
KARL AUGUST STEINHEIL, Germany; '36, printing-telegraph; '38, grounding of wires.

GUGLIELMO MARCONI, Italy; '96, system of wireless telegraphy practical 3,000 miles.









ELISHA GRAY, Amer. '76; invented telephone; '93 telautograph, send writing by wire. DAVID E. HUGHES, America; '78, invented elec. microphone to amplify voice sound.

ALEXANDER GRAHAM BELL, Amer. 76; invents first successful speaking telephone. PHILIP REIS, Ger.; '60, singing telephone; 1864, make and break contact transmitter



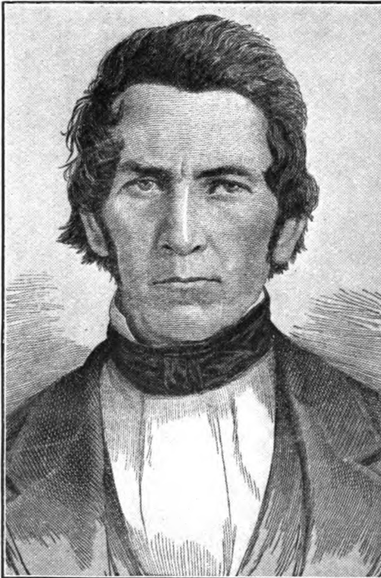






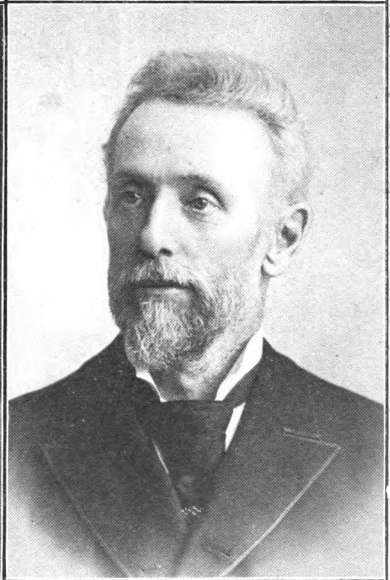
M. H. JACOBI, Russia; 1834, invented first rotary electric motor; 1839, first electric boat. ZENOBIE T. GRAMME, France; '70, invents "Gramme ring," armature for dynamos.

ANTONIO PACINOTTI, Italy; '60, inv't'd ring armature commutator and tooth core. ERNST WERNER VON SIEMENS, Ger. 1866, shuttle armature; 1868, drum armature.









THOMAS DAVENPORT, America; '50, conducted first experiments in electric traction.
FRANK J. SPRAGUE, Amer.; '87, modern electric railway; '97, multiple unit system.

C. J. VAN DERPOELE, America; '85, contact device for overhead electric trolley.
LEO DAFT, Amer.; '85, early electric road, Baltimore. '85 first electric locomotive on "El."



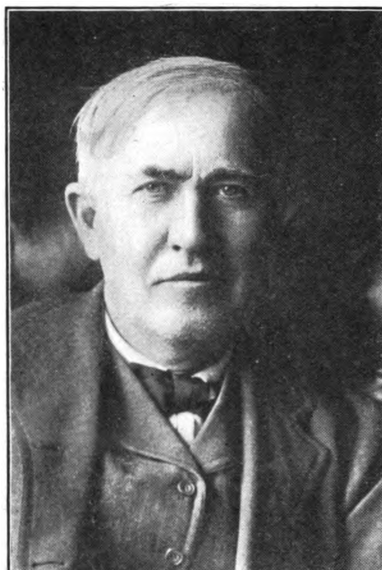


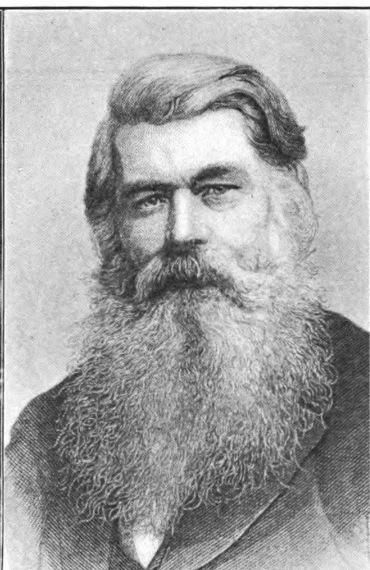




CHARLES F. BRUSH, America; 1878, invented clutch electric arc lamp and dynamo.
EDWARD WESTON, America; 1878, invented many lighting devices and dynamos.

ELIHU THOMSON, America; '78; electric lighting machinery, '86, electric welding.
WALTER NERNST, Ger.; 1897, non-vacuum glower (rare earth) incandescent light.









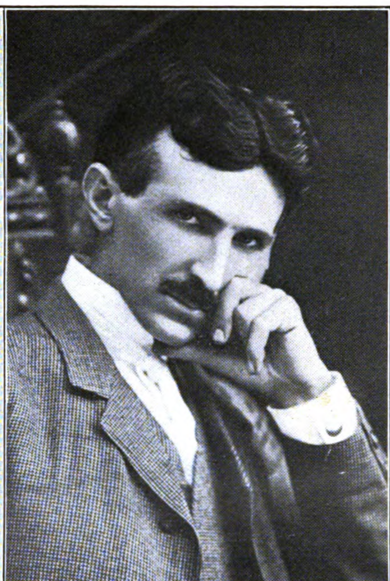
THOMAS A. EDISON, America; '79, carbon filament incand't lamp; 1,000 inventions.

SIR JOSEPH W. SWAN, England; '70, electro chemistry, incandescent electric light.

PETER COOPER HEWITT, America; 1900, mercury vapor light and converter.

D. McFARLAN MOORE, Am.; '98, light from vacuum tubes; colors from different gases.



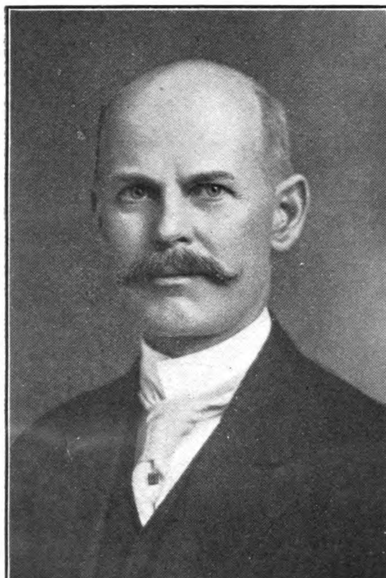






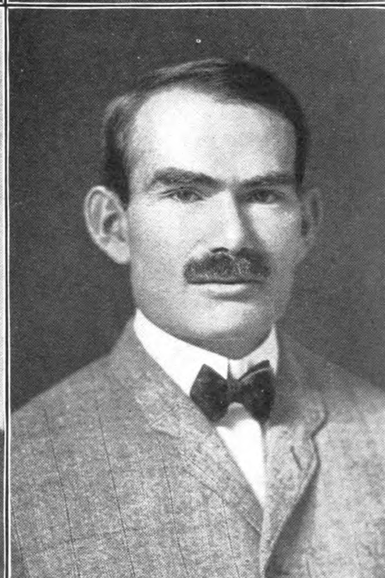
GALILEO FERRARIS, Italy; 1885, discovers alternating current, rotary magnetic field.
RENÉ THURY, France; 1904, long distance, high tension direct current transmission.

NIKOLA TESLA, America; '87, alternating current, transmission and phenomena
MICHAEL I. PUPIN, America; 1900, improved quality and distance 'phone transmiss'n.









EDWARD G. ACHESON, America; '86, processes for carborundum, siloxicon, graphite.
REGINALD A. FESSENDEN, Am.; 1900, mechanism, wireless telegraph and telephone.

CHARLES M. HALL, America; 1886, electrolytic process for making of aluminum.
LEE DE FOREST, America; 1899, responder and sound receiver for wireless telegraphy.



